What is claimed is:

1. A medical pump for use with a pumping chamber, comprising:
a pumping element adapted to intermittently pressurize the pumping chamber during a pumping cycle;
a pressure sensor adapted to detect the pressure exerted by the pumping element on the pumping chamber;
a position sensor operatively associated with the pumping element to detect the position of the pumping element;
a processing unit in electronic communication with the pressure sensor and position sensor; and
a memory coupled to the processing unit, wherein the memory contains programming code executed by the processing unit to process pressure data from the pressure sensor and position data from the position sensor to determine a calculated stroke volume of the pump for a pump cycle, and to adjust a stroke frequency of the pump to compensate for variation between the calculated stroke volume and a desired dosage rate.

2. The medical pump of claim 1, wherein the pressure sensor is the only pressure sensor included in the medical pump.

3. The medical pump of claim 1, wherein the pressure sensor is directly connected to the pumping element.

4. The medical pump of claim 1, wherein the pressure sensor comprises a current signal from a motor connected with the pumping element to drive the pumping element.

5. The medical pump of claim 1, wherein the pressure sensor comprises a strain gauge connected to the pumping chamber.

6. The medical pump of claim 1, wherein pressure sensor comprises a pressure probe located at least partially within the pumping chamber.

7. The medical pump of claim 1, wherein the programming code executed by the processing unit sets a stroke frequency for the desired dosage rate based on a nominal stroke volume, and adjusts the stroke frequency to compensate for variation between the calculated stroke volume and the nominal stroke volume.

8. The medical pump of claim 1, wherein the pumping chamber has an outlet valve, and the programming code executed by the processing unit processes pressure data from the pressure sensor to determine when the outlet valve opens.

9. The medical pump of claim 8, wherein the programming code executed by the processing unit processes pressure data and position data to determine a calculated pressurization volume from a beginning of the pump cycle to the point when the outlet valve opens, and uses the calculated pressurization volume to determine the calculated stroke volume.

10. The medical pump of claim 9, wherein the programming code executed by the processing unit determines a change in pressurization volume by subtracting the calculated pressurization volume from a nominal pressurization volume, determines a change in stroke volume by multiplying the change in pressurization volume by a ratio of pumping chamber expansion under pressure at the middle of the pumping cycle to pumping chamber expansion under pressure at the start of the pumping cycle, and determines the calculated stroke volume based on the change in stroke volume.

11. The medical pump of claim 1 further comprising a cassette for defining the pumping chamber.

12. The medical pump of claim 1, wherein the calculated stroke volume comprises multiple calculated stroke volumes averaged together.

13. A method for monitoring flow rate in a medical pump having a pumping chamber, comprising:
setting a desired pump flow rate;
monitoring the pump cycle with a position sensor to generate a plurality of position data values;
pressurizing the pumping chamber and acquiring a plurality of pressure data values from a pressure sensor during the pump cycle;
processing the pressure and position data values to determine a calculated stroke volume for the pump cycle;
comparing the calculated stroke volume with the desired pump flow rate; and
adjusting the pressure applied to the pumping chamber to compensate for variation between the calculated stroke volume and the desired pump flow rate.

14. The method of claim 13, further comprising the step of supplying only one pressure sensor to the medical pump.

15. The method of claim 13, further comprising the step of connecting the pressure sensor directly to a pumping element in the medical pump.

16. The method of claim 13, further comprising the step of acquiring a plurality of pressure data values from a pressure

sensor where the pressure sensor comprises a current signal from a motor connected with the pumping element to drive the pumping element.

17. The method of claim 13, further comprising the step of acquiring a plurality of pressure data values from a pressure sensor where the pressure sensor comprises a strain gauge connected to the pumping chamber.

18. The method of claim 13, further comprising the step of acquiring a plurality of pressure data values from a pressure sensor where the pressure sensor comprises a pressure probe located at least partially within the pumping chamber.

19. The method of claim 13, further comprising the step of setting a stroke frequency for a desired dosage rate based on a nominal stroke volume, and adjusts the stroke frequency to compensate for variation between the calculated stroke volume and the nominal stroke volume.

20. The method of claim 13, further comprising the step of determining when an outlet valve opens in the pumping chamber of the medical device.

21. The method of claim 20, further comprising the step of determining a calculated pressurization volume from a beginning of the pump cycle to the point when the outlet valve opens, and using the calculated pressurization volume to determine the calculated stroke volume.

22. The method of claim 21, further comprising the step of determining a change in pressurization volume by subtracting the calculated pressurization volume from a nominal

pressurization volume, determining a change in stroke volume by multiplying the change in pressurization volume by a ratio of pumping chamber expansion under pressure at the middle of the pumping cycle to pumping chamber expansion under pressure at the start of the pumping cycle, and determining the calculated stroke volume based on the change in stroke volume.

23. A medical pump for use with a pumping chamber, comprising:

a pumping element adapted to intermittently pressurize the pumping chamber during a pumping cycle;

a pressure sensor adapted to detect the pressure exerted by the pumping element on the pumping chamber;

a position sensor operatively associated with the pumping element to detect the position of the pumping element;

a processing unit in electronic communication with the pressure sensor and position sensor; and

a memory coupled to the processing unit, wherein the memory contains programming code executed by the processing unit to process pressure data from the pressure sensor and position data from the position sensor to:

set a stroke frequency for a desired dosage rate based on a nominal stroke volume,

determine when an outlet valve of the pumping chamber opens,

determine a calculated pressurization volume from a beginning of the pump cycle to the point when the outlet valve opens,

determine a change in pressurization volume by subtracting the calculated pressurization volume from a nominal pressurization volume,

determine a change in stroke volume by multiplying the change in pressurization volume by a ratio of

pumping chamber expansion under pressure at the middle of the pumping cycle to pumping chamber expansion under pressure at the start of the pumping cycle,

determine a calculated stroke volume based on the change in stroke volume, and

adjust the stroke frequency to compensate for variation between the calculated stroke volume and the nominal stroke volume.

24. The medical pump of claim 23 further comprising a cassette for defining the pumping chamber.

25. A medical pump for use with a cassette having a pumping chamber, comprising:

a pumping element adapted to intermittently pressurize the pumping chamber during a pumping cycle;

a pressure sensor adapted to detect the pressure exerted by the pumping element on the pumping chamber;

a position sensor operatively associated with the pumping element to detect the position of the pumping element;

a processing unit in electronic communication with the pressure sensor and position sensor; and

a memory coupled to the processing unit, wherein the memory contains programming code executed by the processing unit to process pressure data from the pressure sensor and position data from the position sensor to determine a calculated stroke volume of the pump for a pump cycle, and to adjust a stroke frequency of the pump to compensate for variation between the calculated stroke volume and a desired pump flow rate.

26. A medical pump for use with a cassette having a pumping

chamber, comprising:

a processing unit; and

a memory coupled to the processing unit, wherein the memory contains programming code executed by the processing unit to control operation of the pump to deliver a flow rate of about 1 ml/hr with bolus volumes of less than 2 µl delivered in increments of not greater than twenty second between said bolus volumes.

27. The medical pump of claim 26, further comprising: a pumping element adapted to intermittently pressurize the pumping chamber during a pumping cycle; a pressure sensor adapted to detect the pressure exerted by the pumping element on the pumping chamber; a position sensor operatively associated with the pumping element to detect the position of the pumping element; wherein the processing unit is in electronic communication with the pressure sensor and position sensor; and wherein the memory contains programming code executed by the processing unit to process pressure data from the pressure sensor and position data from the position sensor to control operation of the pump.

28. The medical pump of claim 26, wherein the memory contains programming code executed by the processing unit to control operation of the pump in a closed loop control system.

29. The medical pump of claim 26, wherein the memory contains programming code executed by the processing unit to control operation of the pump to deliver a flow rate of about 0.1 ml/hr with bolus volumes of less than 2 µl delivered in increments of not greater than twenty second between said bolus volumes.

30. The medical pump of claim 26, wherein the memory contains programming code executed by the processing unit to control operation of the pump to deliver a flow rate of up to 1000 ml/hr.